Budinger & Associates

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GEOTECHNICAL REPORT

To: Rudeen Development, LLC c/o Greg Jefferys

Cc: John Konen, Storhaug Engineering

Date: March 10, 2006

Re: Geotechnical Report, Evaluation of Drainage and Initial Characterization for Road Cuts, – Liberty Lakeview Estates, Liberty Lake, WA (S06011)

Scope and Project Description

We understand that you are proposing the construction of a new residential single-family hillside development on the west side of N Liberty Lake Road, near the intersection of N Liberty Lake Road and Settler Drive, as illustrated in the attached Site Map and Vicinity Map. The project site is approximately 23 acres in size.

Because of the relatively rocky conditions across the site, the project civil engineer, Storhaug Engineering, is developing drainage plans to make best use of subsurface conditions. We understand that the entrance may require a 35-foot thick cut to achieve desired grade.

You requested geotechnical explorations and analysis addressing drainage, stability assessment of proposed road cuts, and related earthwork. In order to expedite civil engineering design, this initial report only addresses subsurface infiltration potential for storm water, as well as initial characterization of road cuts.

Field Explorations

In order to identify subsurface conditions and to provide test sites for in-situ infiltration tests, we conducted 8 test pit explorations. The locations of the test pits are shown on the attached *Site Plan.* We completed the test pit excavations on the 26th of January 2006 using a Case 9010B trackhoe with 2.0-foot wide bucket. They ranged in depth from 2 to 19 feet. Additionally, 6 exploratory borings were completed at depths ranging from 20 to 30 feet below ground surface (bgs) using a Longyear 28 air rotary drill rig.

Test pit backfill was replaced with tamping of the track hoe bucket. Conditions encountered are described in the attached *Test Pit Logs.* A key, labeled *Guide to Soil and Rock Descriptions,* is also attached.

Two test pit infiltration tests were conducted in accordance with *Spokane County Guidelines for Stormwater Management,* Appendix I-4.3. One infiltration test was conducted in the vicinity of TP 1 and the other in the vicinity of TP4. In the following text they are referred to as the northern lobe (TP 1) and southern lobe (TP4). They were approximately located at the northeast corner and near the east central property line, near the existing housing development. These two locations were chosen for their position in topographic low areas and the likelihood that suitable material for drainage would be encountered with depth. Stabilized flow rates, head levels, and test pit dimensions are summarized for the two test sites on the attached table, *Test Pit Infiltration Data.*

Setting

The ground surface slopes east at 15-50%, with the steepest terrain generally occurring on the eastern half of the site. The slopes above the site in the Legacy Hills development are more gradual at approximately 20% or less. According to a topographic plan provided by the project architect, the highest elevation on the site is in the southwest corner (approximately 2300 ft), about 225 feet higher than the lower portions on the eastern boundary near N Liberty Lake Rd. Based on the relatively thin organic layer at the surface, the site appears never to have been tilled. The surface is vegetated with a moderate growth of grasses, Ponderosa Pine, brush and numerous Precambrian metamorphic rock outcrops. To the south and east are an existing residential development and a city of Liberty Lake water tower. To the east is N Liberty Lake Rd, beyond which is a golf course and housing developments. To the north is a vacant field.

The geologic conditions on the subject site can generally be characterized by relatively thin overburden thickness (i.e., soil cover), relatively shallow depth to Precambrian metamorphic bedrock, and relatively shallow depth to groundwater on the eastern side of the site. However there can be significant lateral variability in subsurface conditions such as from the low-lying lobes underlain by gravel and upland terrain underlain at shallow depth by rock.

Regional Geology

The majority of the site is composed of Hauser Lake Gneiss (Precambrian). This material is characterized by rusty weathering, medium-grained, well banded, foliated, and lineated mylonitic biotite-orthoclase-plagioclase-quartz gneiss, and schist that contains minor quartzite. Muscovite-biotite schist layers are less than 1 meter (m) thick and quartz-feldspar layers are more than 1 m thick. Bedding or foliation of schist zones are consistent across large areas of the site, but other discontinuities, such as joints and cleavage planes, are abundant, variably spaced, and variably oriented producing very complex masses of rock with respect to rock mechanics and groundwater flow.

The lobes of lower elevation, where the two infiltration tests were conducted, are composed of a different geologic group of flood deposited material from the Pleistocene time period. This material is a poorly sorted, stratified mixture of gravel, cobbles, boulders, and sand resulting from multiple episodes of catastrophic outbursts from glacier-dammed lakes, such as glacial Lake Missoula which inundated much of the present Clark Fork River drainage in Montana and Idaho.

Encountered Conditions

Four distinct materials were encountered at the site with respect to properties relevant to development of the project: 1) SILT, 2) GRAVEL, 3) SILTY SAND, and 4) ROCK, as described further below. The first areas of the site explored were two small lobes of ground comprised primarily of flood deposited material, on the northeastern and southeastern portion of the site, where the land surface elevation is similar to that of N Liberty Lake Rd. Conditions encountered beneath these lobes included an approximately 1 to 2-foot thick layer of sandy SILT underlain by laminated GRAVEL with thin sand and silt laminations and lenses, to a depth exceeding 30 feet (this area includes TP 1, 2 & TB 9). Beneath the southeastern lobe of the site, at the base of the hillside, Precambrian metamorphic ROCK was encountered in TP 4 and 5, beneath the laminated GRAVEL layer. A few feet away from the hillside no rock was encountered in TB 11. Static groundwater levels in these areas ranged between 23 and 26 feet bgs. In TP 3 and TB 10, directly above and to the west of TP 1 & 2 SILTY SAND was encountered continuously to a depth of 25 feet bgs. The static ground water level in this area was recorded at approximately 22 feet bgs.

Beneath other locations explored at the site, a layer of loose to medium dense, sandy SILT was observed at the ground surface underlain by decomposing and competent Precambrian metamorphic ROCK. Depth to ROCK varies from 0.5 to 1 foot bgs in the borings that encountered this material. In general, the ROCK was composed of several feet of very decomposed and soft material, and then became moderately hard and less decomposed.

Below the sandy SILT unit are coarse-grained GRAVEL outburst flood deposits that include sand, cobbles, and boulders. The GRAVEL layer contains thin interbeds of silt and silty sand. The thickness of the flood materials ranged from 5 to greater than 29 feet, typically increasing to the east and northeast. The true thickness in several locations is not known because flood deposits were not completely penetrated. The conditions of the flood deposits appear to be medium dense to dense.

The grain size analyses show that the percentage passing the # 200 sieve in the minus 3/4 inch fraction of the flood deposits is 5 % or less. The permeability of this stratum is relatively consistent laterally but somewhat reduced vertically by finer textured laminations and lenses. The estimated permeability (k) of the GRAVEL layer ranges from 20 and 130 in/hr. The estimated k-value was calculated from results of field infiltration tests, as described further in the next section.

At five test pit locations, TP 4 through TP 8, ROCK caused refusal below the SILT and GRAVEL at depths ranging from 2 to 11 feet.

During the exploration, groundwater was encountered at three locations but only one (TB 10) was, above the low-lying eastern boundary of the site. At wetter times of the year or during wetter climatic cycles, groundwater could be found perched on the ROCK at other locations. A stream, likely intermittent, was observed at the north end of the project near the area of the thickest proposed cut. The stream is in the vicinity of TP 3 and TB 10, immediately north, and flows east towards TP 1 and N Liberty Lake Road.

Conclusions and Recommendations

The majority of the subject site is unsuitable for infiltration; however, the two lobes on the eastern side of the site appear to be hydraulically connected to flood deposits and are capable of receiving sizable volumes of water over an extended period of time. Field infiltration tests and correlation with laboratory determined index properties demonstrate that the permeability of the flood deposits qualify the GRAVEL layer as a permeable target layer for infiltration.

Soil permeability was assessed by visual observations of soil in borings and test pits, laboratory testing of grain size distribution, and field infiltration testing in two test pits. The stabilized flow rates in these tests were 40 and 260 gallons per minute (gpm) in TP 1 and 2, respectively. Drywell infiltration rates were determined in accordance with the *Infiltration Rates and Soil Classification Correlation (IRSCC), May 28, 2004* developed by Spokane County and the City of Spokane in conjunction with Budinger & Associates, Inc., Cummings Geotechnology, Inc., and GeoEngineers. Criteria include safety factors of 1.8 and 1.3 for TP 1 and 2, respectively, resulting in maximum design infiltration rates of 0.2 and 1.5 cfs, respectively for Type B (two barrel deep) drywells.

We recommend installing three-barrel deep drywells at the northern site to expose as much surface area of the permeable soil as possible and two-barrel deep drywells in the southern site based upon silty laminations and lenses as well as bedrock and groundwater boundaries. Furthermore, we recommend a maximum design outflow rate per drywell of 0.13 cubic feet per second (cfs) beneath the northern drainage area and 0.80 cfs beneath the southern area. The maximum total outflow of the drainage areas should not exceed 0.80 cfs beneath the northern drainage area or 3.2 cfs beneath the southern area, which would limit the total number of drywells in each area to 6 and 4, respectively.

We recommend a minimum center-to-center drywell spacing of 40 feet and a minimum of a 4-foot separation from the base of the drywells to bedrock or static groundwater levels.

Groundwater in the area of TB 10 may have significant impact to road cut design as the depth to groundwater was approximately 22 feet bgs, while current plans are to cut the road to a depth of 35 feet bgs.

Limitations

Services were limited to the exploration, testing, and analysis described herein. This report should not be used for other purposes. Geotechnical engineering for other civil, environmental, or permitting aspects of the project are beyond the scope of this involvement. Other limitations are summarized in the attached document entitled *Important Information About Your Geotechnical Engineering Report.*

We appreciate the opportunity to offer this service. Please call if you have any questions.

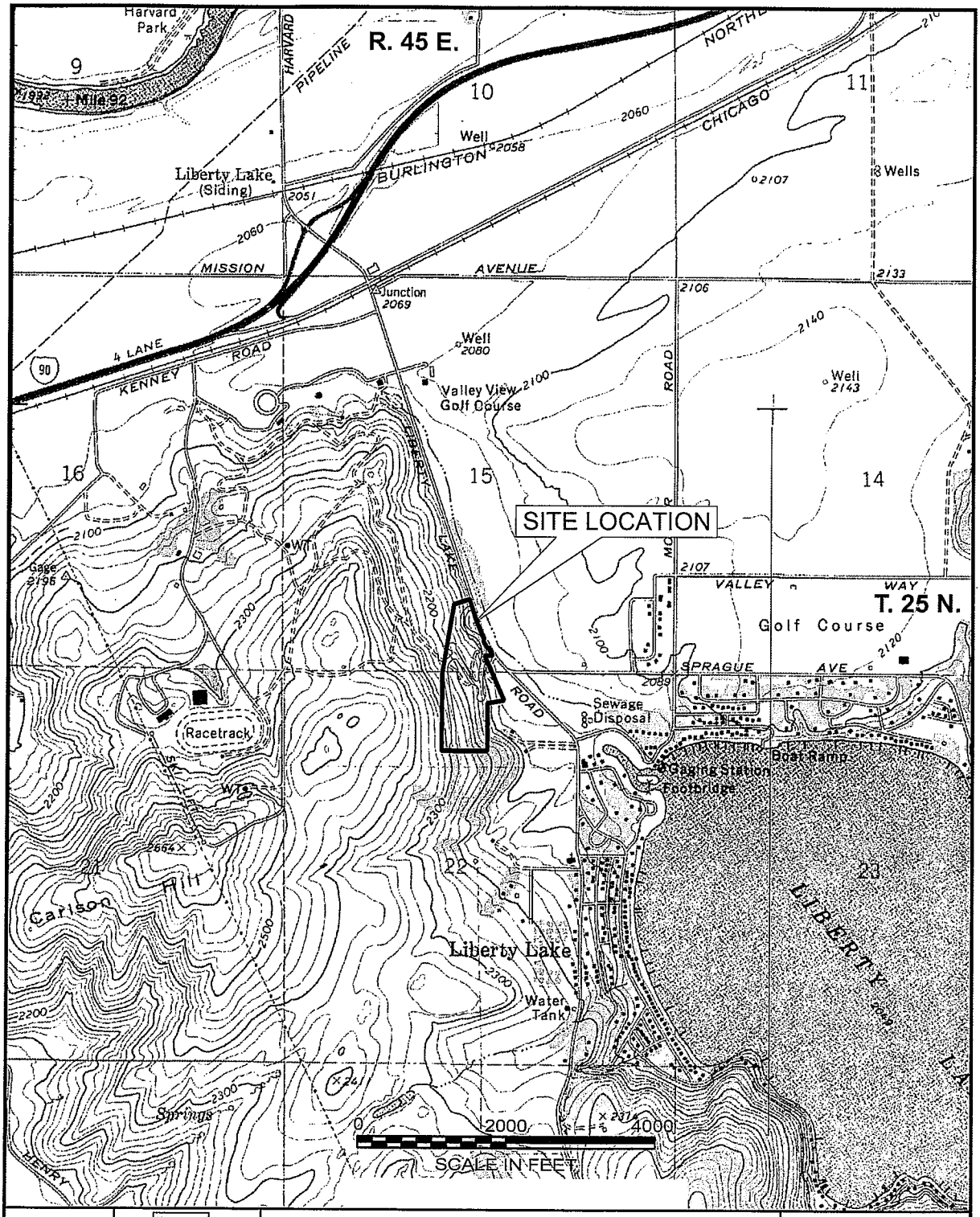
Respectfully Submitted:
BUDINGER & ASSOCIATES, INC.

Ryan Molsee
Hydrogeologist

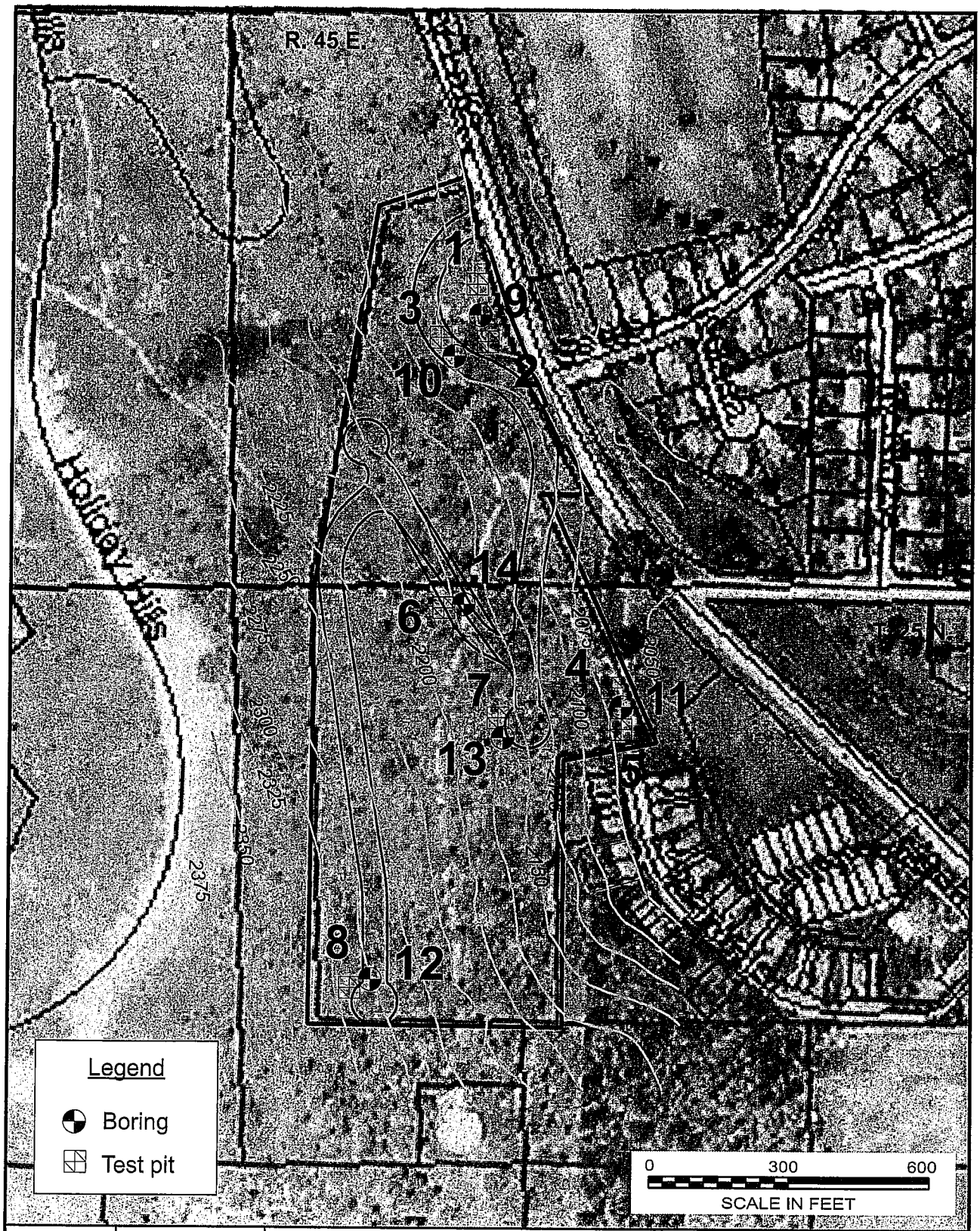
John E. Finnegan, PE
Geotechnical Engineer, Principal

Addressee – 6
Attachments

- Laboratory Summary
- Vicinity Map, Figure 1
- Site Map, Figure 2
- Guide to Soil & Rock Descriptions, Figure 3
- Test Pit Logs, Figures 4-1 thru 4-12
- Test Pit Infiltration Data, Figures 5-1 and 5-2
- Grain Size Distribution Results, Figure 6
- Important Information About Your Geotechnical Engineering Report



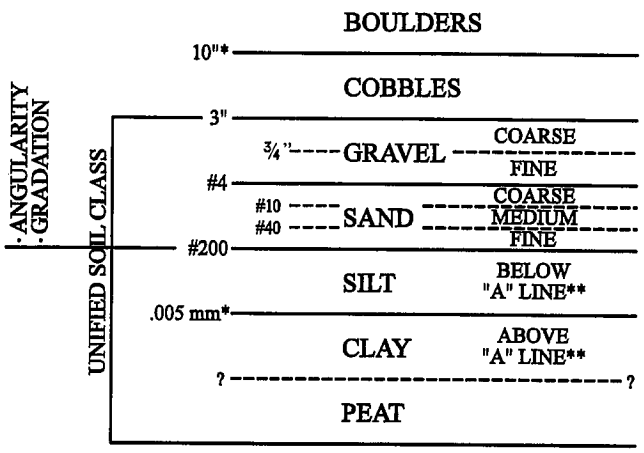
N S06011_VIC.cdr	Budinger & Associates	VICINITY MAP LIBERTY LAKEVIEW ESTATES LAKEVIEW ROAD & SETTLER DRIVE LIBERTY LAKE, WASHINGTON	JOB # S06011 DATE : 1/30/06 FIGURE 1.



N X06012_SITE.cdr	Budinger & Associates	SITE MAP	JOB # X06012
		LIBERTY LAKEVIEW ESTATES LAKEVIEW ROAD LIBERTY LAKE, WASHINGTON	DATE : 1/30/06 FIGURE 2.

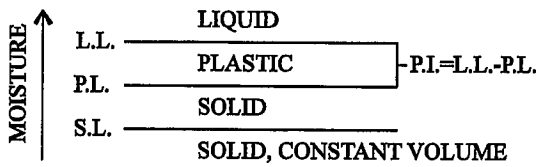
GUIDE TO SOIL & ROCK DESCRIPTIONS

UNIFIED
SOIL CLASSIFICATION SYSTEM
(USCS)

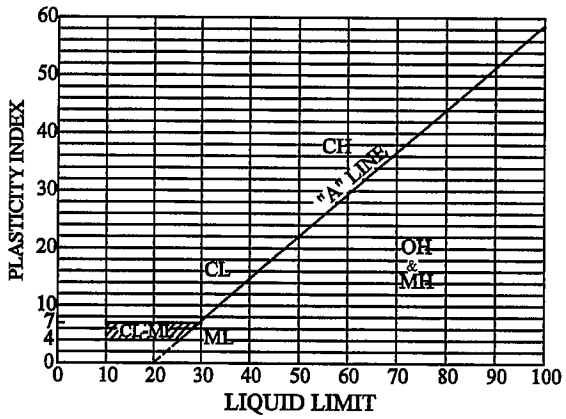


* NOT INCLUDED IN U.S.C.S.
** SEE PLASTICITY CHART

ATTERBERG LIMITS



PLASTICITY CHART



GUIDE TO SOIL DESCRIPTION MODIFIERS, MOISTURE, AND CONDITION PRESENTED ON LOGS.

MODIFIER	ESTIMATED PERCENTAGE OF SAMPLE
SUFFIX "LY" OR "Y".....	GREATER THAN 40%
SOME	22% - 45%
SMALL AMOUNT	8% - 25%
TRACE/OCCASIONAL	0% - 12%

MOISTURE
DRY
SLIGHTLY MOIST
VERY MOIST
SATURATED

CONDITION

COARSE GRAINED:
- VERY LOOSE
- LOOSE
- MEDIUM DENSE
- DENSE
- VERY DENSE

FINE GRAINED:
- VERY SOFT
- SOFT
- MEDIUM
- STIFF
- VERY STIFF
- HARD

ROCK:
- SOFT
- MODERATELY HARD
- HARD
- VERY HARD

▽ GROUNDWATER INDICATION DURING DRILLING

▼ GROUNDWATER INDICATION AFTER DRILLING

SAMPLES

- STANDARD 2" PENETRATION TEST SAMPLER WITH BLOWS PER FOOT
- 3" SPLIT SPOON SAMPLER WITH BLOWS PER FOOT
- DRILL CUTTING SAMPLE
- BULK SAMPLE
- SHELBY TUBE SAMPLE
- DIAMOND CORE RUN WITH % RECOVERY & ROCK QUALITY DESIGNATION
- 4" O.D. SPLIT SPOON SAMPLER WITH BLOWS PER FOOT
- R REFUSAL OF SAMPLE (50+ BLOWS PER 6")

Budinger & Associates, Inc.
Geotechnical & Environmental Engineers
Construction Materials Testing & Inspection

FIGURE 3

TEST PIT 1

Date: 1-26-06
Excavator: Budinger & Assoc., Inc.
Equipment: Case 9010B track hoe, 24" bucket
Location: NE side
Surface: grass and weeds

Logged by: R. Molsee

DEPTH	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0	moist, dark brown, medium dense	SANDY SILT	
5	slightly moist, light brown, medium dense to dense	GRAVEL, some Sand, occasional Boulders, sub-rounded, medium	
10		laminated with thin layers and lenses of silt and sand	
15			
20	no free groundwater observed	End of Excavation @ 19 ft	
25			
30			
35			

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TEST PIT LOGS **FIGURE 4-1**

Project: Liberty Lakeview Estates
Location: N. Liberty Lake Rd, Spokane County, WA
Number: S06011

TEST PIT 2

Date: 1-26-06
Excavator: Budinger & Assoc., Inc.
Equipment: Case 9010B track hoe, 24" bucket
Location: NE side
Surface: grass and weeds

Logged by: R. Molsee

DEPTH	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0	slightly moist, dark brown, medium dense	SANDY SILT	
	dry to slightly moist, light brown, medium dense to dense	GRAVEL, some Sand, occasional Boulders, sub-rounded, medium	
5			
10		laminated with thin layers and lenses of silt and sand	
15			
20	no free groundwater observed	End of Excavation @ 19 ft	
25			
30			
35			

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TEST PIT LOGS **FIGURE 4-2**

Project: Liberty Lakeview Estates
Location: N. Liberty Lake Rd, Spokane County, WA
Number: S06011

TEST PIT 3

Date: 1-26-06
Excavator: Budinger & Assoc., Inc.
Equipment: Case 9010B track hoe, 24" bucket
Location: N side
Surface: grass and weeds

Logged by: R. Molsee

DEPTH	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0	moist, dark brown, loose to medium dense	SILT	
	moist, light brown, medium dense to dense	SAND, some Gravel, fine to medium	
15	moist, light gray, medium dense to dense	SAND, some Gravel and Cobbles, fine to medium	
	no free groundwater observed	End of Excavation @ 15 ft	

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TEST PIT LOGS **FIGURE 4-3**

Project: Liberty Lakeview Estates
Location: N. Liberty Lake Rd, Spokane County, WA
Number: S06011

TEST PIT 4

Date: 1-26-06
Excavator: Budinger & Assoc., Inc.
Equipment: Case 9010B track hoe, 24" bucket
Location: E Central
Surface: grass and weeds

Logged by: R. Molsee

DEPTH	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0	moist, dark brown, loose to medium dense	SILT	
5	dry to slightly moist, gray with brown, medium dense to dense	SAND, some Gravel and Silt Some laminated gravel with thin layers of silt	
10	slightly moist, brown to orange, loose to medium dense	SAND, medium to coarse	
15	dry, gray, soft no free groundwater observed	GNEISS/SCHIST End of Excavation @ 11 ft	
20			
25			
30			
35			

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TEST PIT LOGS **FIGURE 4-4**

Project: Liberty Lakeview Estates
Location: N. Liberty Lake Rd, Spokane County, WA
Number: S06011

TEST PIT 5

Date: 1-26-06
Excavator: Budinger & Assoc., Inc.
Equipment: Case 9010B track hoe, 24" bucket
Location: E Central
Surface: grass and weeds

Logged by: R. Molsee

DEPTH	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0	moist to wet, dark brown, loose to medium dense	SILT	
	moist, light brown, medium dense	SILTY SAND, medium to coarse	
5	dry, gray, soft	Weathered GNEISS/SCHIST	
	no free groundwater observed	End of Excavation @ 6 ft	
10			
15			
20			
25			
30			
35			

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TEST PIT LOGS **FIGURE 4-5**

Project: Liberty Lakeview Estates
Location: N. Liberty Lake Rd, Spokane County, WA
Number: S06011

TEST PIT 6

Date: 1-26-06
Excavator: Budinger & Assoc., Inc.
Equipment: Case 9010B track hoe, 24" bucket
Location: Central
Surface: grass and weeds

Logged by: R. Molsee

DEPTH	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0	moist, dark brown, loose to medium dense	SILT	
	dry to slightly moist, light brownish gray, very dense	SILTY SAND and weathered gneiss/schist (transition zone)	
5	dry to slightly moist, gray, soft	GNEISS/SCHIST	
	no free groundwater observed	End of Excavation @ 2 ft	
10			
15			
20			
25			
30			
35			

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TEST PIT LOGS **FIGURE 4-6**

Project: Liberty Lakeview Estates
Location: N. Liberty Lake Rd, Spokane County, WA
Number: S06011

TEST PIT 7

Date: 1-26-06
Excavator: Budinger & Assoc., Inc.
Equipment: Case 9010B track hoe, 24" bucket
Location: Central
Surface: grass and weeds

Logged by: R. Molsee

DEPTH		MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG	
0		moist, dark brown, loose to medium dense	SILT		
		dry to moist, grayish brown, soft	Weathered GNEISS/SCHIST with sand		
5		no free groundwater observed	End of Excavation @ 2.5 ft		
10					
15					
20					
25					
30					
35					

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TEST PIT LOGS **FIGURE 4-7**

Project: Liberty Lakeview Estates
Location: N. Liberty Lake Rd, Spokane County, WA
Number: S06011

TEST PIT 8

Date: 1-26-06
Excavator: Budinger & Assoc., Inc.
Equipment: Case 9010B track hoe, 24" bucket
Location: SW corner
Surface: grass and weeds

Logged by: R. Molsee

DEPTH	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0	moist, dark brown, loose to medium dense	SILT	
	moist, grayish brown, dense	SILTY SAND, with weathered rock	
	dry to slightly moist, gray, soft	GNEISS/SCHIST with some sand	
5	no free groundwater observed	End of Excavation @ 3 ft	
10			
15			
20			
25			
30			
35			

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TEST PIT LOGS **FIGURE 4-8**

Project: Liberty Lakeview Estates
Location: N. Liberty Lake Rd, Spokane County, WA
Number: S06011

TEST BORING 9

Date of Boring: 2-8-06
Driller: Budinger & Assoc., Inc.
Type of Drill: Longyear 28
Location: NE side
Surface: grass and weeds

Logged by: R. Molsee
Size of hole: 4-1/2" O.D. air rotary

DEPTH	SAMPLES	RQD, BLOW COUNTS N (% RECOVERY) (blows/6" (italics))	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0			moist, dark brown, loose to medium dense	SILT	
			slightly moist, light brown, medium dense	GRAVELLY SAND, some Silt, small amount-some Cobbles, occasional Boulder, subangular-subrounded	
5					
10				laminations and lenses of silt	
15		20 (30%)			
20		R (0%)		Water was initially observed in SANDY SILT material. After boring was complete, groundwater level rose to approximately 23 feet bgs.	
25			saturated, light brown, medium dense to dense	SANDY SILT	
			saturated, light brown, dense	GRAVELLY SAND, some Silt, small amount-some Cobbles, occasional Boulder, subangular-subrounded	
30		R (22%)			
				End of Boring @ 30 ft	
35					

TEST RESULTS

ATTERBERG LIMITS
PL ⊢——⊣ LL
WATER CONTENT ○
STANDARD PEN TEST, N-VALUE (OBSERVED) ◪
3" SPLIT SPOON PENETRATION, BLOWS/FT ■

10 20 30 40 50 60 70 80 90

+100

+100

LWWWT NO ELEV S06011.GPJ BUDINGER.GDT 3/10/06

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BORING LOGS **FIGURE 4-9**

Project: Liberty Lakeview Estates
Location: N. Liberty Lake Rd, Spokane County, WA
Number: S06011

TEST BORING 10

Date of Boring: 2-14-06
Driller: Budinger & Assoc., Inc.
Type of Drill: Longyear 28
Location: Northern
Surface: grass and weeds

Logged by: R. Molsee
Size of hole: 4-1/2" O.D. air rotary

DEPTH	SAMPLES RQD, BLOW COUNTS N (% RECOVERY) (blows/6" (italics))	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0		moist, dark brown, loose	SILT	
		moist, brown/red brown, very dense	SILTY SAND, medium to coarse (saturated at approximately 20 feet)	
5				
10				
15				
20	R (50%)		observed wet sand at approximately 23' bgs, after boring was completed water level was measured at 22' bgs	
25	R (30%)		End of Boring @ 25 ft	
30				
35				

TEST RESULTS

ATTERBERG LIMITS
PL — LL
WATER CONTENT O
STANDARD PEN TEST, N-VALUE (OBSERVED)
3" SPLIT SPOON PENETRATION, BLOWS/FT

10 20 30 40 50 60 70 80 90

+100

+100

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BORING LOGS **FIGURE 4-10**

Project: Liberty Lakeview Estates
Location: N. Liberty Lake Rd, Spokane County, WA
Number: S06011

TEST BORING 11

Date of Boring: 2-15-06
Driller: Budinger & Assoc., Inc.
Type of Drill: Longyear 28
Location: E Central
Surface: grass and weeds

Logged by: R. Molsee
Size of hole: 4-1/2" O.D. air rotary

DEPTH	SAMPLES RQD, BLOW COUNTS N (% RECOVERY) *(blows/6" (italics))*	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0		moist, brown, loose to medium dense	SILT, occasional Gravel, trace Organics: roots, poorly graded (fine-medium)	
5		dry to slightly moist, grayish brown, very dense	GRAVELLY SAND, small amount-some Cobbles, occasional Boulder, subangular-subrounded	
10				
15			laminated gravels with thin layers of silt	
20	R (16%)			
25	R (8%)	saturated	no saturated cuttings were observed during boring, however after completion water level was detected at apporximately 26' bgs	
30	R (4%)			
			End of Boring @ 30 ft	
35				

TEST RESULTS

ATTERBERG LIMITS
PL — LL
WATER CONTENT ○
STANDARD PEN TEST, N-VALUE (OBSERVED)
3" SPLIT SPOON PENETRATION, BLOWS/FT

10 20 30 40 50 60 70 80 90

+100 +100 +100

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BORING LOGS **FIGURE 4-11**

Project: Liberty Lakeview Estates
Location: N. Liberty Lake Rd, Spokane County, WA
Number: S06011

TEST BORING 12

Date of Boring: 2-15-06
Driller: Budinger & Assoc., Inc.
Type of Drill: Longyear 28
Location: SW corner
Surface: grass and weeds

Logged by: R. Molsee
Size of hole: 4-1/2" O.D. air rotary

DEPTH	SAMPLES	RQD, BLOW COUNTS N (% RECOVERY) (blows/6" (italics))	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0			moist, brown, loose to medium dense	SILTY SAND, occasional Gravel, trace Organics (roots), poorly graded (fine-medium)	
			dry, gray, soft	decomposed GNEISS/SCHIST	
5					
10					
15					
20			moderately hard	becomes moderatly hard at approximatly 22' bgs	
25			no free groundwater observed	End of Boring @ 25 ft	
30					
35					

TEST RESULTS

ATTERBERG LIMITS
PL — LL
WATER CONTENT ○
STANDARD PEN TEST, N-VALUE (OBSERVED)
3" SPLIT SPOON PENETRATION, BLOWS/FT

10 20 30 40 50 60 70 80 90

LWWWT NO ELEV S06011.GPJ BUDINGER.GDT 3/10/06

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BORING LOGS **FIGURE 4-12**

Project: Liberty Lakeview Estates
Location: N. Liberty Lake Rd, Spokane County, WA
Number: S06011

TEST BORING 13

Date of Boring: 2-16-06
Driller: Budinger & Assoc., Inc.
Type of Drill: Longyear 28
Location: Central
Surface: grass and weeds

Logged by: R. Molsee
Size of hole: 4-1/2" O.D. air rotary

DEPTH	SAMPLES	RQD, BLOW COUNTS N (% RECOVERY) (blows/6" (italics))	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0			slightly moist, brown, loose to medium dense	SILTY SAND, occasional Gravel, trace, Organics (roots), poorly graded (fine-medium)	
			dry, gray with brown, soft	decomposed GNEISS/SCHIST	
5					
10			moderately hard	GNEISS/SCHIST becomes harder at a depth of approximately 9' bgs	
15					
20					
25			no free groundwater observed	End of Boring @ 25 ft	
30					
35					

TEST RESULTS

ATTERBERG LIMITS
PL — LL
WATER CONTENT ○
STANDARD PEN TEST, N-VALUE (OBSERVED)
3" SPLIT SPOON PENETRATION, BLOWS/FT

10 20 30 40 50 60 70 80 90

LWWWT NO ELEV S06011.GPJ BUDINGER.GDT 3/10/06

Budinger & Associates
3820 E. Broadway Ave.
Spokane, WA 99202

BORING LOGS **FIGURE 4-13**

Project: Liberty Lakeview Estates
Location: N. Liberty Lake Rd, Spokane County, WA
Number: S06011

TEST BORING 14

Date of Boring: 2-17-06
Driller: Budinger & Assoc., Inc.
Type of Drill: Longyear 28
Location: Central
Surface: grass and weeds

Logged by: R. Molsee
Size of hole: 4-1/2" O.D. air rotary

DEPTH	SAMPLES	RQD, BLOW COUNTS N (% RECOVERY) *(blows/6" (italics))*	MOISTURE, COLOR, CONDITION	DESCRIPTION	SOIL LOG
0			dry, light gray, soft	weathered GNEISS/SCHIST	
5					
10			moist, reddish brown, medium dense	SANDY SILT with organics and tree roots	
15			dry, light gray, moderately hard	GNEISS/SCHIST	
20			no free groundwater observed	End of Boring @ 20 ft	
25					
30					
35					

TEST RESULTS

ATTERBERG LIMITS
PL ⊢——⊣ LL
WATER CONTENT ○
STANDARD PEN TEST, N-VALUE (OBSERVED) ◪
3" SPLIT SPOON PENETRATION, BLOWS/FT ■

10 20 30 40 50 60 70 80 90

LWWWT NO ELEV S06011.GPJ BUDINGER.GDT 3/10/06

Budinger & Associates
3820 E. Broadway Ave.
Spokane, WA 99202

BORING LOGS **FIGURE 4-14**

Project: Liberty Lakeview Estates
Location: N. Liberty Lake Rd, Spokane County, WA
Number: S06011

Figure 5-1
Test Pit Infiltration Data

WL BGS = water level depth below ground surface (ft)
WL Elev = water level elevation (ft)

Test Pit #1

Total Depth (ft)	10.0
Surface Elevation (ft)	2330
Bottom Elevation (ft)	2320
Bottom dimensions	3' x 7'
Gravel	3' to 10' below grade

			Total flow rate				
Date/Time	Time (min)	meter 1 (gal)	cum. (gal)	(gpm)	WL BGS	WL Elev	Head
1/31/2006 14:52	0.00	272900	0	0			
1/31/2006 14:57	5.00	273630	730	146.0	3.0	2327.0	7.0
1/31/2006 15:03	11.00	273880	980	41.7	3.2	2326.8	6.8
1/31/2006 15:10	18.00	274180	1280	42.9	3.0	2327.0	7.0
1/31/2006 15:20	28.00	274470	1570	29.0	3.0	2327.0	7.0
1/31/2006 15:30	38.00	274830	1930	36.0	3.0	2327.0	7.0
1/31/2006 15:40	48.00	275380	2480	55.0	3.0	2327.0	7.0
1/31/2006 15:50	58.00	275620	2720	24.0	3.3	2326.7	6.7
1/31/2006 16:00	68.00	275940	3040	32.0	3.4	2326.6	6.6
1/31/2006 16:10	78.00	276390	3490	45.0	3.2	2326.8	6.8
1/31/2006 16:20	88.00	276810	3910	42.0	3.1	2326.9	6.9
1/31/2006 16:30	98.00	277240	4340	43.0	3.1	2326.9	6.9
1/31/2006 16:40	108.00	277590	4690	35.0	3.0	2327.0	7.0
1/31/2006 16:50	118.00	278160	5260	57.0	3.0	2327.0	7.0
1/31/2006 17:00	128.00	278510	5610	35.0	3.0	2327.0	7.0
1/31/2006 17:01	129.00				3.2	2326.8	6.8
1/31/2006 17:03	131.00				3.3	2326.7	6.7
1/31/2006 17:05	133.00				3.7	2326.3	6.3
1/31/2006 17:07	135.00				4.3	2325.7	5.7
1/31/2006 17:09	137.00				4.8	2325.2	5.2
1/31/2006 17:11	139.00				5.3	2324.7	4.7
1/31/2006 17:20	148.00				6.8	2323.2	3.2

Average gpm @ constant head
39.8

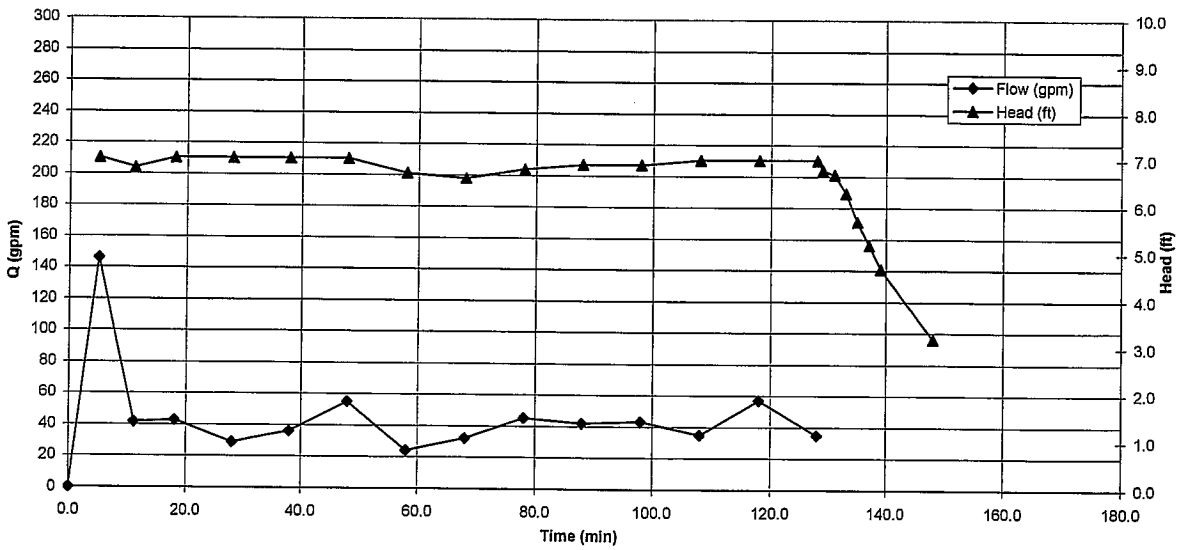


Figure 5-2
Test Pit Infiltration Data

WL BGS = water level depth below ground surface (ft)
WL Elev = water level elevation (ft)

Test Pit #2

Total Depth (ft)	12.0
Surface Elevation (ft)	2330
Bottom Elevation (ft)	2318
Bottom dimensions	3' x 7'
Gravel	5' to 12' below grade

			Total flow rate				
Date/Time	Time (min)	meter 1 (gal)	cum. (gal)	(gpm)	WL BGS	WL Elev	Head
2/2/2006 10:20	0.00	279510	0	0			
2/2/2006 10:40	20.00	284470	4960	248.0	6.0	2324.0	6.0
2/2/2006 10:50	30.00	287050	7540	258.0	5.7	2324.3	6.3
2/2/2006 11:00	40.00	289770	10260	272.0	5.6	2324.4	6.4
2/2/2006 11:10	50.00	292380	12870	261.0	5.6	2324.4	6.4
2/2/2006 11:20	60.00	294920	15410	254.0	5.6	2324.4	6.4
2/2/2006 11:30	70.00	297520	18010	260.0	5.6	2324.4	6.4
2/2/2006 11:40	80.00	300260	20750	274.0	5.6	2324.4	6.4
2/2/2006 11:50	90.00	302870	23360	261.0	5.7	2324.3	6.3
2/2/2006 12:00	100.00	305420	25910	255.0	5.7	2324.3	6.3
2/2/2006 12:10	110.00	308050	28540	263.0	5.7	2324.3	6.3
2/2/2006 12:20	120.00	310780	31270	273.0	5.7	2324.3	6.3
2/2/2006 12:22	122.00				7.0	2323.0	5.0
2/2/2006 12:23	123.00				8.0	2322.0	4.0
2/2/2006 12:25	125.00				9.0	2321.0	3.0
2/2/2006 12:29	129.00				10.0	2320.0	2.0
2/2/2006 12:37	137.00				11.0	2319.0	1.0

Average gpm @ constant head
262.6

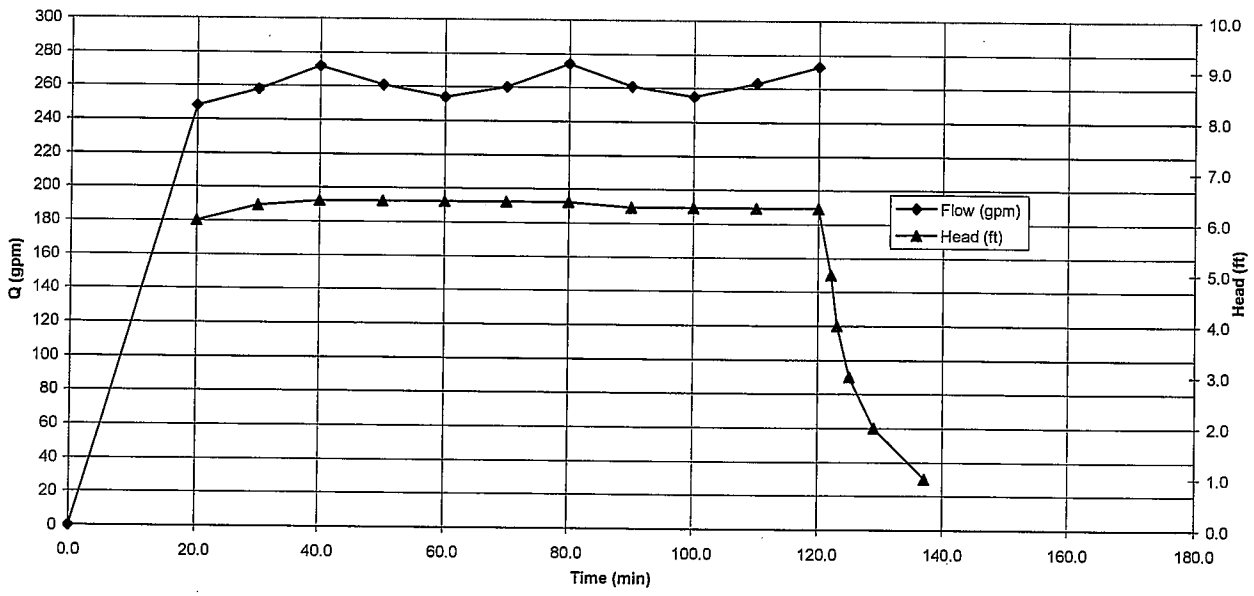
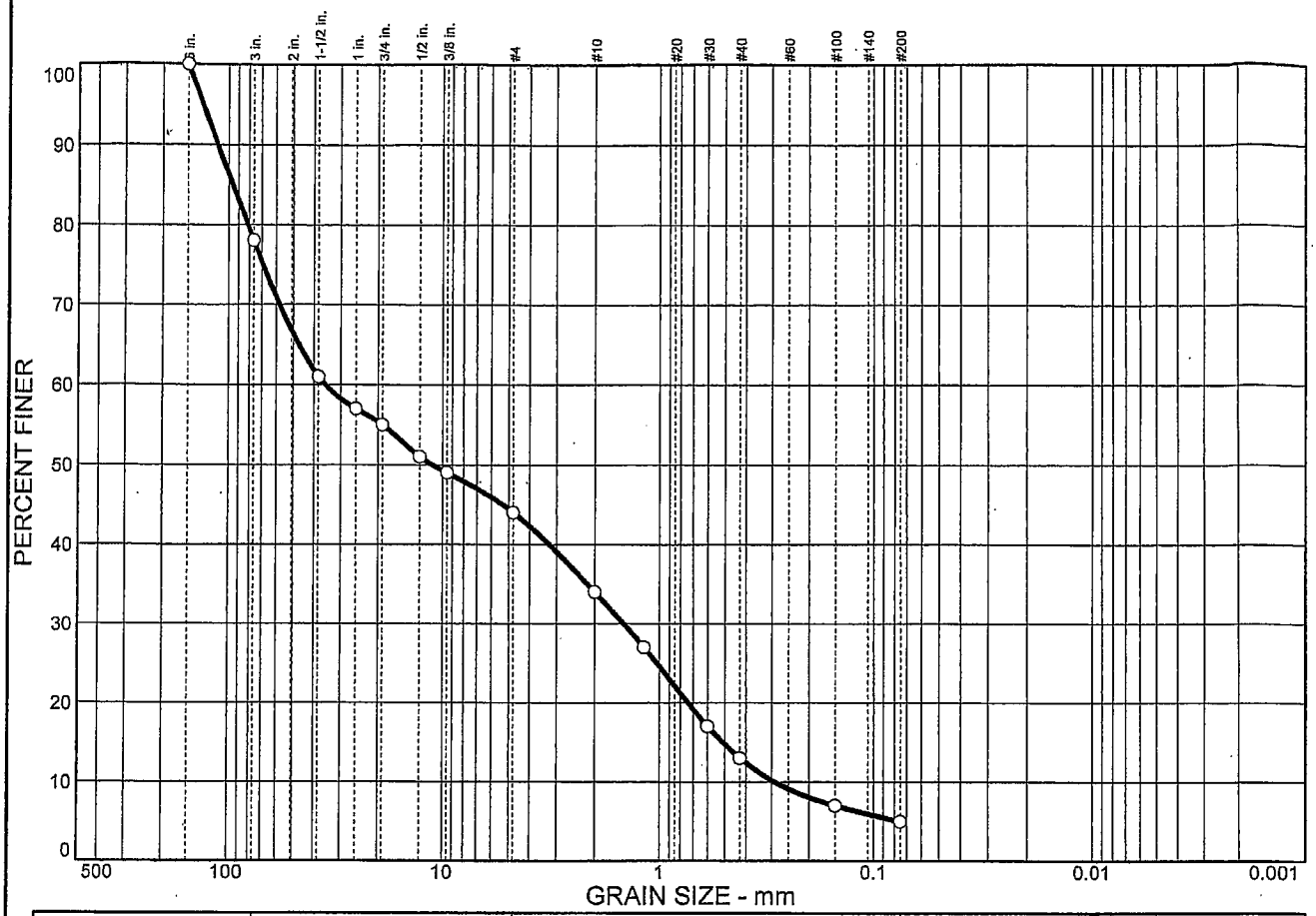


Figure 6 - Grain Size Distribution Results

SIEVE ANALYSIS



% COBBLES	% GRAVEL	% SAND	% SILT	% CLAY
22.0	34.0	39.0	5.0	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
6 in.	100.0		
3 in.	78.0		
1.5 in.	61.0		
1 in.	57.0		
3/4 in.	55.0		
1/2 in.	51.0		
3/8 in.	49.0		
#4	44.0		
#10	34.0		
#16	27.0		
#30	17.0		
#40	13.0		
#100	7.0		
#200	5.0		

* (no specification provided)

Soil Description

Atterberg Limits

PL= LL= PI=

Coefficients

D_{85}= 95.6 D_{60}= 35.5 D_{50}= 11.1
D_{30}= 1.47 D_{15}= 0.512 D_{10}= 0.292
C_u= 121.54 C_c= 0.21

Classification

USCS= SP-SM AASHTO=

Remarks

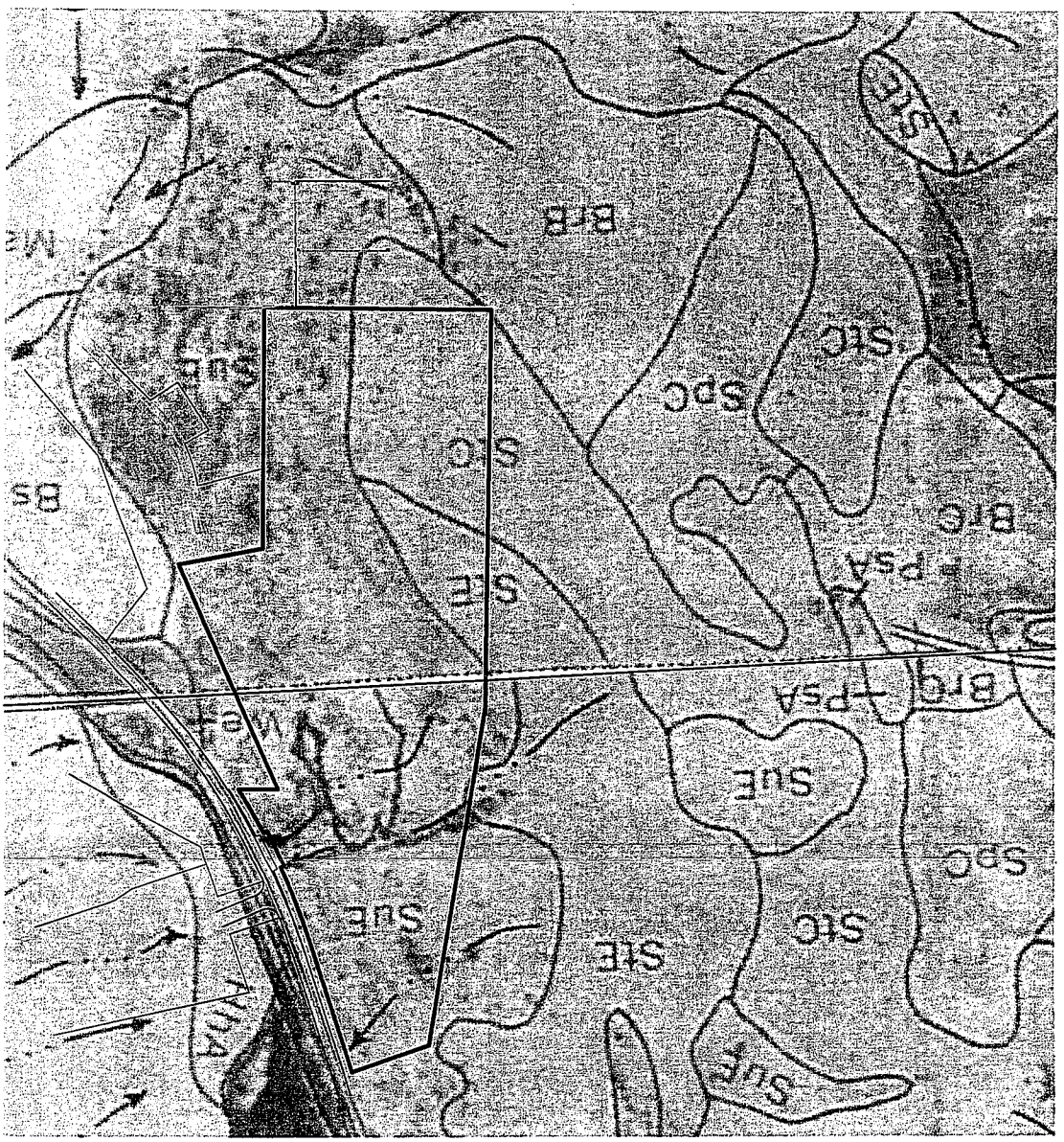
Sampled by B&A

Sample No.: 1 (06-0064) **Source of Sample:** On site **Date:** 1/27/06
Location: **Elev./Depth:**

BUDINGER & ASSOCIATES, INC.

Client:
Project: Liberty Lake Estates
Project No: S06011 **Reviewed By:**

06004-e-drainage.dwg Soils



GRAPHIC SCALE

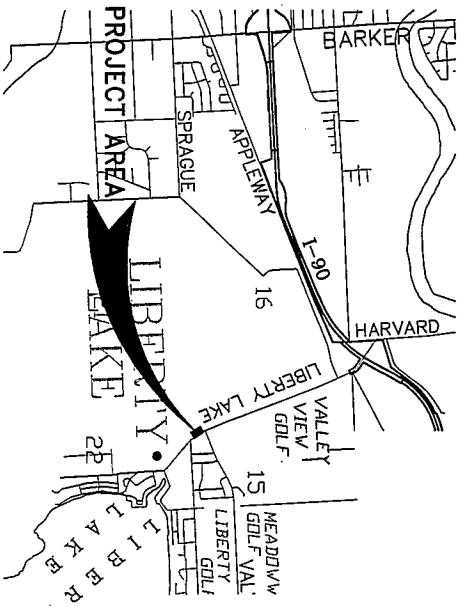
(IN FEET)

HORZ: 1 inch = 300 ft.

300 0 150 300 600

VICINITY MAP

NTS



CALL BEFORE YOU DIG 456-8000

DRAWN	EMF	DATE	6/14/06
CHECKED	JDS	SCALE	1"=200'
1 OF 2		EXHIBIT	1
PROJECT NUMBER	06-004		

SOILS INFORMATION
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LIBERTY LAKE, WASHINGTON

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